Making Sense of China's Excessive Foreign Reserves

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- If every Chinese buys more American goods, trade between China and the US would be more balanced.
- Why don't Chinese spend their dollars and buy American goods?

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  - One popular argument: an undervalued home currency promotes employment.
  - However, selling goods at significantly low prices and holding \$ as a store of value = lending goods to Americans in return for IOUs that pay negative interest.
  - Why would the Chinese tighten their belts and lend to Americans when they are still struggling with very low per capita income? Shouldn't they borrow from Americans instead?

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- Even though China has had impressive economic growth over the past 30 years, its financial sector reform has not caught up with its economic growth:
  - lack of social safety nets
  - missing insurance markets
  - severe borrowing constraints
- Chinese must save excessively to insure themselves against idiosyncratic uncertainty, such as bad income shocks, unemployment risk, accidents, and many unexpected spending needs such as housing, education, health care, and so on.

Economic Theory Predicts:

- When households face large uninsured risk and are subject to severe borrowing constraints,

- Indeed, during the past 30 years of rapid growth, China's C/Y ratio has fallen from 50% in 1980 to 35% in 2008, while China's national saving rate (I+NX)/Y has been increasing from 34% to 51% (see Figure 1).

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  - in sharp contrast to PIH (Friedman, 1957).
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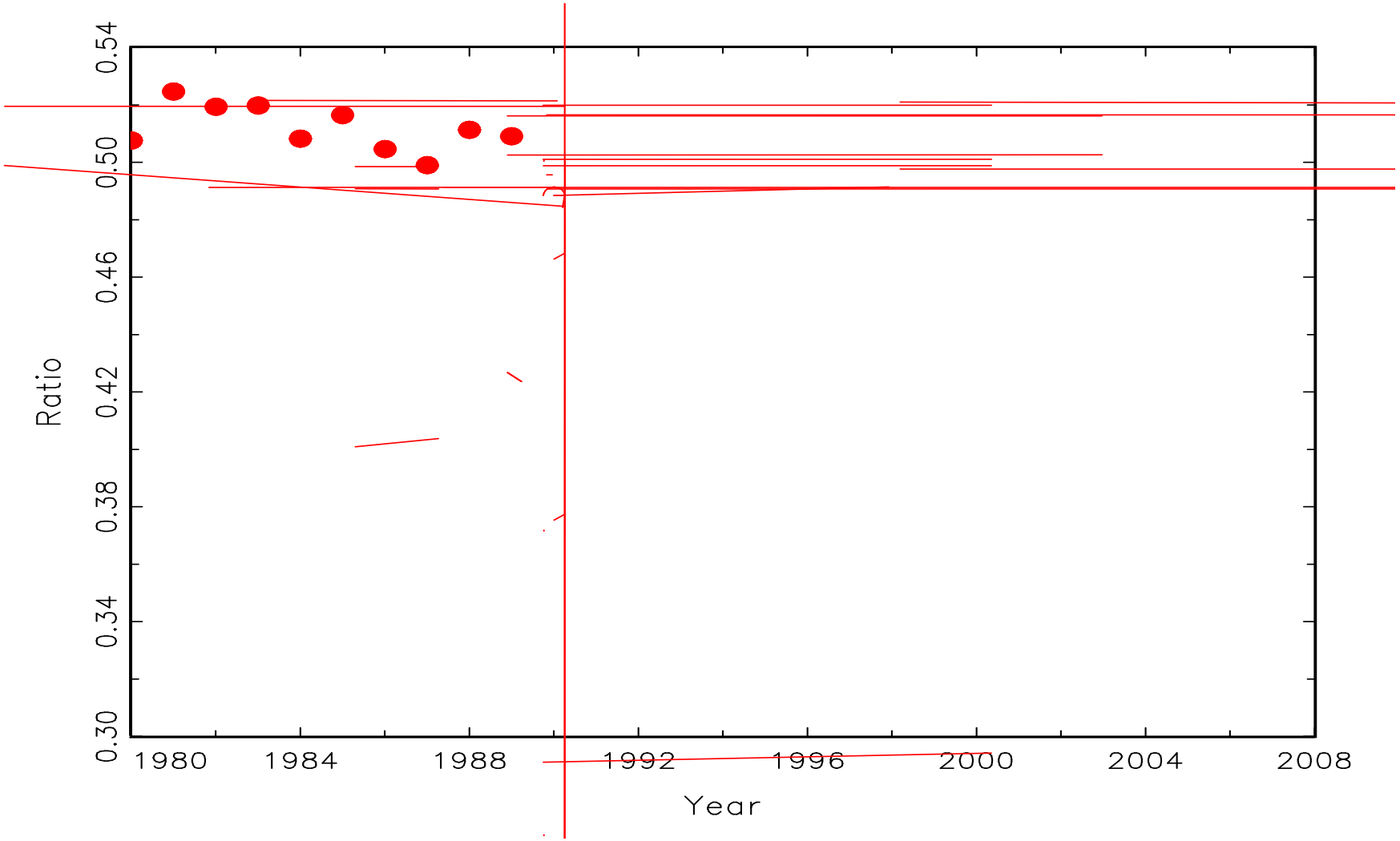
Figure 1


Ratio
0.54
0.50
0.46
0.42
0.38
0.34
0.30
1980
1984
1988
1992
1996
2000
2004
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Year

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  - Japan (1960-70s),
  - Hong Kong (1980s),
  - Taiwan and South Korea (1990s),
  - but the gigantic size of China makes the phenomenon far more alarming and astonishing.

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- If the private sectors want to increase spending on American goods, in principle they can exchange dollars back from Gov by selling bonds.
- Therefore, foreign-exchange reserves held by the Gov are effectively owned by the private sector and they reflect nothing but private savings of Chinese households and firms.

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- Ironically, if Chinese savers were free to put their money anywhere in the world, there could be a large outflow of RMB into other currencies and a resulting depreciation rather than appreciation.
- By forcing China to appreciate its currency may succeed in discouraging Americans from buying Chinese goods, but *will not stop the Chinese households from precautionary saving* and, consequently, China will not buy significantly any more goods from America than they used to.

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- By forcing China to appreciate its currency may succeed in discouraging Americans from buying Chinese goods, but *will not stop the Chinese households from precautionary saving* and, consequently, China will not buy significantly any more goods from America than they used to.
- Thus, such policy proposal has undesirable consequences—it increases the import prices at the cost of American consumers *yet without stimulating the US exports to China*, hurting the welfare of both Americans and Chinese workers.

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- However, this literature does not directly explain the excessive foreign reserves in China.

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4. Therefore, further valuation of the RMB may lead to catastrophic disasters in the future once China's capital control is lifted.

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- Households can mitigate (bypass) capital controls though working in both nontradable and tradable sectors
  - able to adjust basket of consumption goods for tradable and nontradable by adjusting labor supply.

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- A foreign currency—serve either as the means of payment for tradable goods or as a store of value.
- Continuum of households $i \in [0, 1]$. Each has two members (husband and wife), one works in nontradable sector and the other in exporting sector (—perfect risk sharing, can be relaxed for welfare analysis).

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- An competitive financial intermediary pulls the savings from households in sector 1 and rents the capital to firms in the nontradable sector. The competitive factor prices:

$$r_t + \delta = \alpha \frac{Y_{1t}}{K_t} \tag{1}$$

$$W_{1t} = (1-\alpha) \frac{Y_{1t}}{N_{1t}} \tag{2}$$

$$W_{2t} = A_t$$

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Households

- Labor supply is predetermined before $\theta_t(i)$.
- Household i's problem

$$\max E \sum_{t=0}^{\infty} \beta^t \quad \theta_t(i) \left[\log c_{ht}(i) + \log c_{ft}(i)\right] - a n_{1t}(i) - a n_{2t}(i)$$

subject to

$$c_{ht}(i) + (1+g)\, s_{t+1}(i) \leq (1+r_t)\, s_t(i) + W_{10} n_{1t}(i) \tag{3}$$

$$s_{t+1}(i) \quad 0 \tag{4}$$

$$P_t^* c_{ft}(i) + (1+g)\, m_{t+1}(i) \leq m_t(i) + P_t^* W_{20} n_{2t}(i) \tag{5}$$

$$m_{t+1}(i) \quad 0, \tag{6}$$

and $n_{1t}(i), n_{2t}(i) \quad 0$.

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Note the following implications of the model:

- If there were no idiosyncratic uncertainty, households would set consumption equal to wage income in each period in both sectors. Hence, the trade balance would be zero and there would be no accumulation of foreign reserves.

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- If there were no borrowing constraints, households would set consumption equal to permanent income by borrowing from outside. Hence, the country would run big trade deficit with F, as predicted by the PIH.

General Equilibrium

1. Sequences of decision rules $\{c_{ht}(i), c_{ft}(i), s_{t+1}(i), m_{t+1}(i), n_{1t}(i), n_{2t}(i)\}_{t=0}^{\infty}$, such that given prices $\{P_t^*, r_t, W_{1t}, W_{2t}\}_{t=0}^{\infty}$, these decision rules maximize each household's lifetime utility.

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2. Sequence of demand functions $\{K_t, N_{1t}, N_{2t}\}_{t=0}^{\infty}$, such that given prices $\{P_t^*, r_t, W_{1t}, W_{2t}\}_{t=0}^{\infty}$, these demand functions maximize firms' profits.

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3. The law of large numbers hold and all markets clear: $\int S_t(i)di = K_t$, $\int n_{1t}(i)di = N_{1t}$, $\int n_{2t}(i)di = N_{2t}$, $\int C_{Ht}(i)di + K_{t+1} - (1-\delta)K_t = Y_{1t}$, $\int C_{Ft}(i)di + \frac{\int M_{t+1}(i)di - \int M_t(i)di}{P_t^*} = Y_{2t}$ (trade deficit $= \frac{M_{t+1}-M_t}{P_t^*}$).
4. The transversality conditions hold: $\lim_{T\to\infty} \beta^T \frac{K_{T+1}}{W_T} = 0$ and $\lim_{T\to\infty} \beta^T \frac{\frac{1}{P_t^*}\int M_{T+1}(i)di}{W_T} = 0$.

Household Decision Rules

The decision rules of consumption, asset demand, real balances, and cash-in-hand (x_t) are given by

$$c_{ht}(i) = \min\left\{\frac{\theta_t(i)}{\theta_{1t}^*}, 1\right\} x_{1t} \tag{7}$$

$$c_{ft}(i) = \min\left\{\frac{\theta_t(i)}{\theta_{2t}^*}, 1\right\} x_{2t} \tag{8}$$

$$(1+g)\, s_{t+1}(i) = \max\left\{\frac{\theta_{1t}^* - \theta_t(i)}{\theta_{1t}^*}, 0\right\} x_{1t} \tag{9}$$

$$(1+g)\,\frac{m_{t+1}(i)}{P_t^*} = \max\left\{\frac{\theta_{2t}^* - \theta_t(i)}{\theta_{2t}^*}, 0\right\} x_{2t} \tag{10}$$

$$x_{1t} = \theta_{1t}^* \left[\beta \frac{1+r}{(1+g)\, W_{10}}\right]^{-1} \tag{11}$$

$$x_{2t} = \theta_{2t}^* \left[\frac{\beta}{(1+g)\,(1+v)\, W_{20}}\right]^{-1}, \tag{12}$$

Household Decision Rules

- The cutoff variables $\theta_{1t}^*, \theta_{2t}^*$ are determined by the following two equations,

$$1 + g = \beta (1 + r) R(\theta_{1t}^*) \tag{13}$$

$$1 + g = \frac{\beta}{1 + v} R(\theta_{2t}^*), \tag{14}$$

where the function $R(\cdot)$ is given by

$$R(\theta^*) \equiv \int_{\theta < \theta^*} dF(\theta) + \int_{\theta \quad \theta^*} \frac{\theta}{\theta^*} dF(\theta) > 1. \tag{15}$$

- Note $\frac{\partial R}{\partial \theta^*} < 0$. That is, with a higher cutoff, the liquidity constraint is less likely to bind, thus the liquidity value of savings is lower.

Discussion

- Consider tradable sector: Since $R(\cdot)$ is bounded below by 1 and above by $R(\underline{\theta}) = \frac{E\theta}{\underline{\theta}} > 1$, $\exists$ a minimum $v_{\min} = \frac{\beta}{1+g} - 1$ such that if $v \leq v_{\min}$, the optimal money demand is infinity (Friedman Rule); and a maximum $v_{\max} = \frac{\beta}{1+g}\frac{E\theta}{\underline{\theta}} - 1$ such that if v $v_{\max}$ the optimal money demand for dollars is zero.
- In $1 + g = \frac{\beta}{1+v} R(\theta^*_{2t})$, the LHS is the marginal cost of saving — the opportunity cost of not consuming the rising income is proportional to the income growth rate. The RHS measures the effective rate of return to saving, including the real interest rate $(\frac{\beta}{1+v})$ and the liquidity premium.
- In equilibrium the liquidity premium R is an increasing function of income growth $g \Longrightarrow\Longrightarrow$ "High Growth Leads to High Saving."

Aggregation

- By the law of large numbers, aggregate (or average) consumption, saving, and asset demand are given by

$$c_{ht} = D(\theta_1^*)x_{1t} \tag{16}$$

$$c_{ft} = D(\theta_2^*)x_{2t} \tag{17}$$

$$(1+g)\, s_{t+1} = H(\theta_1^*)x_{1t} \tag{18}$$

$$(1+g)\,\frac{m_{t+1}}{P_t^*} = H(\theta_2^*)x_{2t}, \tag{19}$$

  where $D(\theta^*) = \int_{\theta<\theta^*} \frac{\theta}{\theta^*} dF(\theta) + \int_{\theta \quad \theta^*} dF(\theta) \in (0,1)$ and $H(\theta^*) = \int_{\theta<\theta^*} \frac{\theta^*-\theta}{\theta^*} dF(\theta) \in (0,1)$. Note $D(\cdot) + H(\cdot) = 1$.
- Optimal hours worked N_{1t}, N_{2t} can be solved by

$$W_{10} N_1 = (1 - H(\theta_1^*))\, x_1 > 0 \tag{20}$$

$$W_{20} N_2 = (1 - H(\theta_2^*))\, x_2 > 0. \tag{21}$$

Aggregate Saving Rate

- Define $\wp_j$ as disposable income in sector j:

$$\wp_{1t} = rS_t + W_{10}N_{1t} = X_{1t} - S_t \tag{22}$$

$$\wp_{2t} = W_{20}N_{2t} = X_{2t} - \frac{M_t}{P_t^*} \tag{23}$$

- The saving rate for each sector is the ratio of net changes in asset position and disposable income:

$$\tau_1 = \frac{S_{t+1} - S_t}{\wp_{1t}} = \frac{(1+g)\, s_{t+1} - s_t}{x_{1t} - s_t} = \frac{gH(\theta_1^*)}{1+g-H(\theta_1^*)} \tag{24}$$

$$\tau_2 = \frac{M_{t+1} - M_t}{P_t^* \wp_{1t}} = \frac{(1+g)\, m_{t+1} - m_t}{P_t^* x_{2t} - m_t} = \frac{gH(\theta_2^*)}{1+g-H(\theta_2^*)}. \tag{25}$$

- The saving rate is an increasing function of the rate of income growth, $\frac{d\tau}{dg} > 0$, provided that g is not too large.
- Intuition:

Calibration

- Pareto distribution,

$$F(\theta) = 1 - \theta^{-\sigma}$$

with $\sigma > 1$ and $\theta \in (1, \infty)$. An infinite value of θ indicates life-threaten medical need. But the probability of such events is infinitely small.

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Figure 2

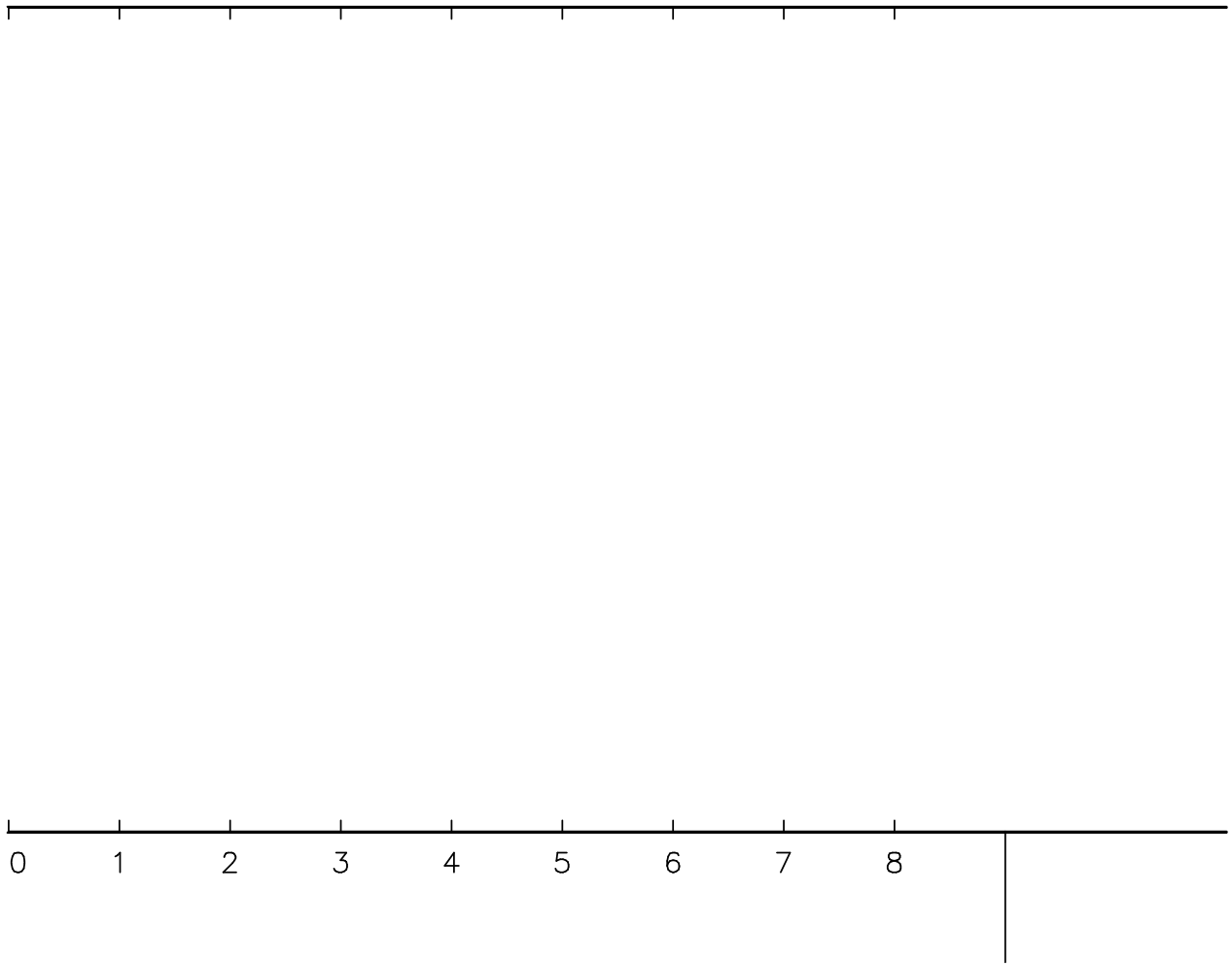
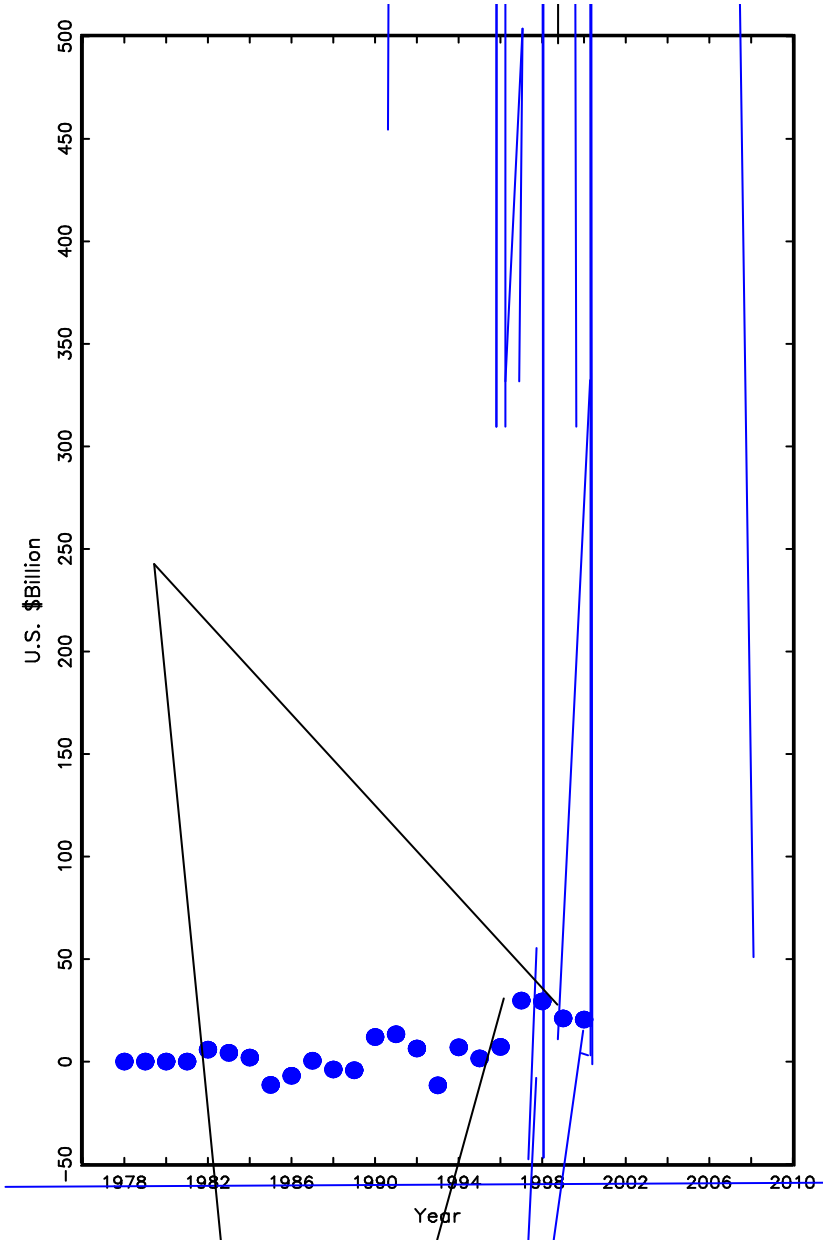


Figure 2. Saving Rate as a Function of Growth.

Predicting China's Foreign Reserves

Given the average growth rate of export income in China (about 20% per year between 1978-2009), our model implies a precautionary saving rate of 26% in the tradable sector. Based on this information, multiplying China's total exports ($P_t^* Y_{2t}$) by 0.26 would generate the predicted year-to-year changes in foreign reserves in the model (Figure 3):

Figure 3


U.S. $Billion
500
450
400
350
300
250
200
150
100
50
0
−50
1978
1982
1986
1990
1994
1998
2002
2006
2010
Year

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- Dollar supply

$$S = \alpha + \theta e = 275 + \theta e$$

Dollar demand

$$D = \beta - \theta e = 425 - \theta e;$$

where $\theta = 18$. Given $e = 7(¥/\$)$, $S = \$401$ billion and $D = \$299$ billion. Trade surplus $= \$102$ billion, about 25% of export income (as in China).

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- The market-clearing exchange rate would be e^* $4.2(¥/\$)$ $\Longrightarrow$ 40% appreciation as suggested by Paul Krugman.

Thought Experiment

1. However, precautionary-saving demand for dollars (American assets) by Chinese households has been ignored. Suppose all workers in the tradable sector choose to hold dollars as a saving device. This amount of asset demand for dollars is about 25.4% of the export income (or $0.254 \times 401 = 102$ billion in our framework), which implies $\beta = 425 + 102 = 527$ and $e^* = 7(¥/\$)$, instead of $4.2(¥/\$)$.

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- In addition, if all precautionary savings in China are counted and translated into demand for Foreign assets, there would be a huge pressure for dollars to appreciate against RBM. Ex: Assume annual household saving rate in China is 25% of GDP—about 5 times larger than the ratio of trade surplus-to-GDP, which translates into $5 \times 102 = \$510$ billion excess demand for \$ in our framework. So $\beta = 527 + 510 = 1037$ and $e^* = \frac{1037-275}{2\times 18} = 21.167(¥/\$)$. That is more than 200% depreciation.

Thought Experiment

- Even if the optimal portfolio of a typical Chinese household is to hold $\frac{1}{2}$ savings in dollars and $\frac{1}{2}$ in RMB, then total demand for dollars from both sectors 1 & 2 $= \frac{102+510}{2} = \$306$ billion, which implies $\beta = 425 + 306 = 731$ and e

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1. China's excessive foreign reserves are not the consequence of a linked exchange rate or a undervalued home cu(ho)vency, bho the o of an inefficient financial system in conjction with rapid income g(ho)owth—typical for all emerging econhoies.
2. The fundamental determinates of the exchange rate include nho j excess demand of tradable goods bho also excess demand of international assets. Therefore, taking into account the inefficient financial system in China and the excessive amount of precautionary savings of Chinese households, the current exchange rate of RMB has been significantly overvalued, instead of undervalued.

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  - A collapse of Chinese asset markets would trigger a world-wide recession bigger than the aftermath of the Asian financial crisis, given the sheer size of the Chinese economy and its integration with the world.
- A final question is: If the RMB has already overvalued, why has the RMB been appreciating in recent years? The answer lies in

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  - This policy can also pave the way for a floating exchange rate in the future.